BIOTECHNOLOGY
CAPABILITIES

Sandia National Laboratories

Microscale Immune and Cell Analysis

Studying immunity—one cell at a time

A Revolutionary Capability

Researchers at Sandia National Laboratories have created a sophisticated, integrated platform for single-cell manipulation and interrogation.

Called Microscale Immune and Cell Analysis (MICA), this platform represents a revolutionary breakthrough in biological research. MICA offers experimenters the ability to understand cell behavior at the molecular and cellular levels with unprecedented speed, resolution, sensitivity, and multiplexing.

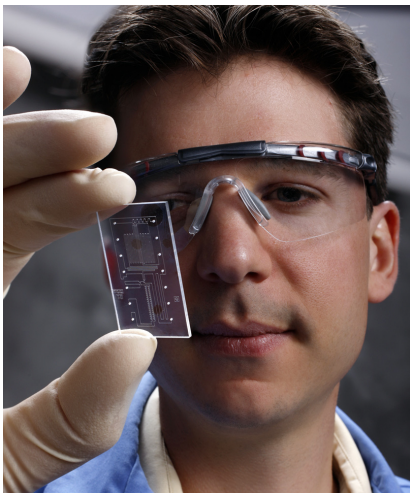
Unlike other lab-on-a-chip platforms, MICA helps researchers target, sort, and measure samples as small as a single cell in a precise, automated system that incorporates flow cytometry. And because MICA is based on microfluidics, it enables biological measurements that are impossible at a conventional scale.

The promise of MICA is immense. MICA has already proven its value in a major Sandia research program that is investigating the responses of immune cells to pathogens. When fully developed as a research tool, the MICA platform may enable scientists to integrate experimentation on myriad cell types, thereby providing a systems understanding of multiple cellular mechanisms that have long eluded researchers.

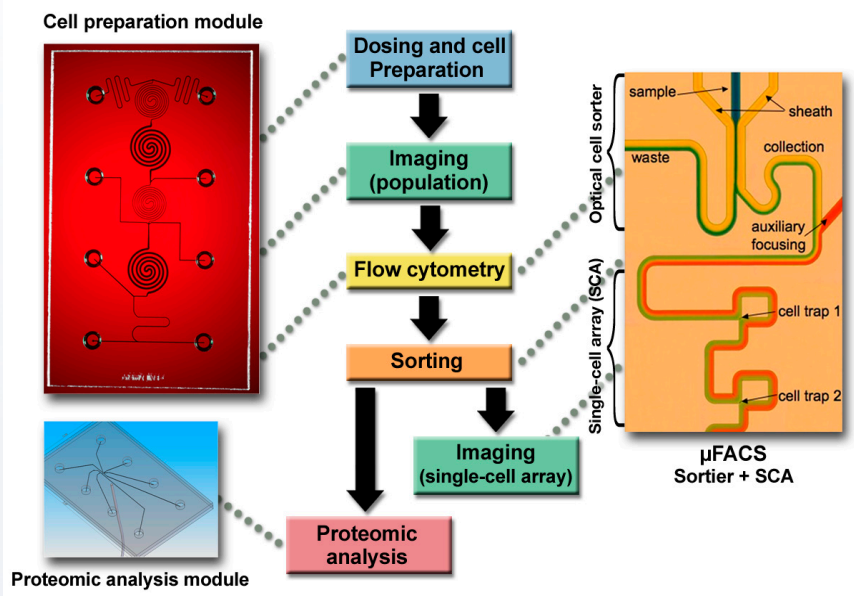
Unlocking the Secrets of Cell Behavior

MICA helps researchers unlock the secrets of cell functions by offering an integrated platform of tools that include dosing, cell preparation, imaging, flow cytometry, sorting, and single-cell arrays (SCAs). These tools can be used to perform comprehensive biology experiments and measurements on samples as small as a single cell.

MICA also offers high-sensitivity and high-throughput analyses that are both rapid and convenient. By using MICA, researchers can automate and integrate cellular experiments, thereby yielding rich—and sometimes previously unknown—findings.



Sandia's unique integrated platform helps experimenters understand cell behavior at the molecular and single-cell level.

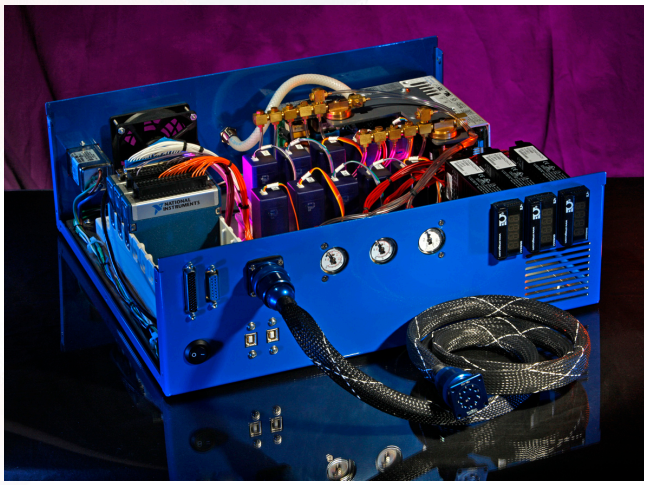


MICA offers an integrated platform of tools for use on samples as small as a single cell.

Differentiating Benefits and Advantages

MICA offers an array of benefits over conventional approaches:

- **New functionality.** MICA offers the capability to perform experimentation and measurement at single-cell resolution; this is not possible with commercial fluorescence-activated cell sorter (FACS) or proteomic techniques.
- **Systems understanding.** MICA is a single, unified platform that can perform multiple measurements (e.g., translocation and protein abundance measurements) on the same population of cells, enabling understanding of the entire system of cell responses.



The Sandia-designed and -engineered microfluidic device accurately delivers fluids onto chips.

- **Speed and efficiency.** Researchers can use MICA to measure multiple components of cellular pathways simultaneously and quickly—without requiring large quantities of cells and expensive reagents.
- **Enhanced control.** MICA's systems integration capability eliminates manual steps and provides scientists with complete control of the cell environment—enabling measurements of concentration and time events.
- **Convenient.** MICA neatly fits on a typical microscope stage.
- **Versatility.** MICA can handle many different cell types, and the MICA hardware adapts to many commercial microscopes.

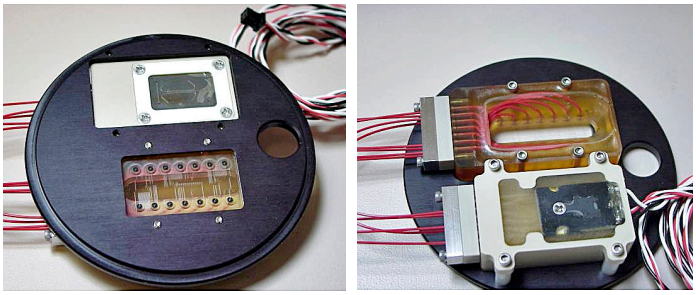
MICA platforms have several key, differentiating features:

- Hands-free, automated operation
- Integrated valves and pumps
- Complete fluid control
- Multiple sample and reagent inlets
- Precise temperature control
- Reusability after following well-established cleaning protocols
- Automated, labview-based, user-friendly interface
- Completely contained platform for biological assays
- Minimal aerosol generation
- Improved biosafety
- Ideal for placement in Biosafety Level (BSL) 3 and 4 facilities

Applications

Within Sandia's research of immune response, MICA has increased our understanding of exactly how immune cells counter viral or bacterial invasion. When fully developed, MICA could revolutionize the study of multiple cell mechanisms, engendering knowledge to advance biology, medicine, diagnostics, and therapeutics. Potential applications of MICA include the following:

- **Drug discovery and therapeutics.** High information-content screening, evaluating how drug candidates behave with specific cell types in real time
- **Diagnostics.** Observing and sorting abnormal cells, enriching rare cell types
- **Personalized medicine.** Monitoring the behavior of individual patient cells
- **Immune and infectious disease.** Observing the mechanisms of infection
- **Biomarker discovery.** Identifying and quantifying specific proteins (e.g., cytokine profiling)



MICA adapts to many commercial microscopes and is ideal for use in BSL-3 and -4 facilities.

For More Information

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